

**Request for Reconsideration:**

In response to the Office Action mailed March 23, 2004, and in accordance with a telephone conversation with Examiner Leo on May 25, 2004, Applicant hereby amends claims 1 and 4 and adds new claims 7 and 8. In view of the previous cancelation of claims 3 and 6, the addition of claims 7 and 8 does not increase the total number of claims considered in the application. These amendments add a description of “a plurality of recess portions” to claims 1 and 4. Moreover, new claims 7 and 8 describe a relationship between the “plurality of recess portions” and the drain path. No new matter is added by these amendments, and the amendments are fully supported by the specification. Appl'n, Page 7, Lines 27-31, and Page 8, Lines 1-4; **Figs. 8-11.** Consequently, Applicant respectfully requests that the Examiner enter the foregoing amendments and reconsider the above-captioned patent application in view of the foregoing amendments and following remarks.

**REMARKS**

1. Rejections

Applicant acknowledges with appreciation that the Examiner has withdrawn the previous objections to the drawings and to claim 2. Nevertheless, claims 1 and 2 stand rejected under 35 U.S.C. § 102(b), as allegedly anticipated by Japanese Patent No. JP-03-57101294A to Ohara. Moreover, claims 1, 2, 4, and 5 stand rejected under 35 U.S.C. § 103(a), as allegedly rendered obvious by Ohara in view of any of U.S. Patent No. 3,292,690 to Donaldson, U.S. Patent No. 5,697,433 to Kato, and U.S. Patent No. 6,453,989 to Watanabe *et al.* (“Watanabe”). Applicant respectfully traverse.

2. Anticipation

As noted above, the Office Action rejects claims 1 and 2 as allegedly anticipated by Ohara. “A claim is anticipated if and only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” MPEP 2131. The Office Action alleges that Ohara describes each and every element as set forth in claim 1. Specifically, the Office Action alleges that Ohara’s **Figs. 3-6 and 8** anticipate claims 1 and 2 (which depends from claim 1). See, e.g., Office Action, Page 2, Lines 10-11. In view of the foregoing amendments, Applicant respectfully traverses.

Applicant’s claims 1 and 4 describe a heat exchanger in which “a plurality of continuous projection portions project into said refrigerant path and extend in an oblique direction relative to said inner fin . . . and each of said plurality of projection portions are positioned across the entire width of said refrigerant path.” (Emphasis added.) As Applicant has noted in its previous Responsive Amendment,

projection portions 50 and projection portions 51 may be formed integrally with first tube plate 44 and second tube plate 45, respectively, such that the number of parts or components of heat exchanger may not increase. Moreover, because each projection portion 50 and each recess portion 54 are formed across the entire width of refrigerant path 46, recess portions 54 may be in fluid communication with drain path 56. For example, referring to **Fig. 10**, the refrigerant path is represented by twelve (12) vertical, broken lines, and protrusions 50 extend across the entire width of the refrigerant path, *i.e.*, intersect with all of the vertical, broken lines representing the refrigerant path. Similarly, because each

projection portion 51 and each recess portion 55 are formed across the entire width of refrigerant path 47, recess portions 55 also may be in fluid communication with drain path 56. Consequently, as shown in **Fig. 11**, water may not be retained between heat transfer tube 43 and outer fin 3 because recess portions 54 and 55 guide the water to drain path 56.

Appl'n, Page 7 Lines 27-31; Page 8, Lines 1-4; and **Figs. 8-11**.

In response to Applicant's previous remarks, the Office Action contends that Applicant's remarks are not commensurate with the scope of the claims. In particular, the Office Action contends that the projection portions 50, which are formed to extend into the interior of the tubes do not affect fluid communication with drain paths 56, which are formed on the exterior of the tubes. In a telephone conversation, the Examiner suggested that Applicant consider amending the pending claims to describe a plurality of recesses formed in a side of at least one tube plate opposite and corresponding to said plurality of projection portions. Therefore, Applicant is amending claims 1 and 4 of the pending claims accordingly. Further, Applicant is adding new claims 7 and 8, which describe the relationship between these recessed portions and a drain path.

In addition, the Office Action asserts that Ohara discloses "discontinuous" projections.<sup>1</sup> Thus, the Office Action suggests that Applicant may distinguish over Ohara (**Fig. 8**) by clarifying that the projected portions are continuous.<sup>2</sup> Therefore, Applicant also is amending claims 1 and 4 to clarify the "continuous" nature of the projected portions.

In view of the foregoing amendments and remarks, Applicant maintains that claims 1 and 4 are distinguished over Ohara. Applicant respectfully requests that the Examiner withdraw the anticipation rejections of claims 1 and 2 over Ohara.

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<sup>1</sup> The Office Action refers to an unofficial, verbal translation of page 6 of Ohara. Office Action, Page 4, Lines 14-15. For the Examiner's convenience, Applicant is enclosing a partial translation of Ohara (Page 2, Col. 6, Lines 9-18).

<sup>2</sup> The Office Action stated that the pending claims fail to specify that the projections are "discontinuous" (Office Action, Page 4, Lines 10-18), but during the telephone conversation, the Examiner explained that the Office Action should have said "continuous."

3. Obviousness

As noted above, the Office Action rejects claims 1, 2, 4, and 5, as allegedly rendered obvious by Ohara in view of any of Donaldson, Kato, and Watanabe. In order for the Office Action to establish a prima facie case of obviousness, at least three criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to those of ordinary skill in the art, to modify the primary reference as proposed by the Office Action. Second, there must be a reasonable expectation of success. Third, the prior art references must disclose or suggest all the claim limitations. MPEP 2143. For the reasons set forth below, Applicant maintains that the Office Action fails to establish a prima facie case of obviousness.

As noted above, Applicant's claims 1 and 4 describe a heat exchanger in which "a plurality of continuous projection portions project into said refrigerant path and extend in an oblique direction relative to said inner fin . . . and each of said plurality of projection portions are positioned across the entire width of said refrigerant path." (Emphasis added.) For the reasons set forth above, Applicant maintains that Ohara does not disclose or suggest the features of the claimed invention, as set forth in amended claims 1 and 4. Moreover, the Office Action does not allege that any of Donaldson, Kato, and Watanabe disclose or suggest these missing limitations.

In view of the foregoing amendments and remarks, Applicant maintains that claims 1 and 4 are distinguished over Ohara in view of any of Donaldson, Kato, and Watanabe. Applicant respectfully requests that the Examiner withdraw the obviousness rejections of claims 1 and 4. Moreover, claims 2 and 5 depend from amended claims 1 and 4, respectively. "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." MPEP 2143.03 (citations omitted). Therefore, Applicant respectfully requests that the Examiner also withdraw the obviousness rejections of claims 2 and 5.

**CONCLUSION**

Applicant respectfully submits that this application, as amended, is in condition for allowance, and such disposition is earnestly solicited. If the Examiner believes that an interview with Applicant's representatives, either in person or by telephone, would expedite prosecution of this application, we would welcome such an opportunity.

PATENT  
Attorney Docket No. 018842.1204

Applicant believes that no fees are due as a result of this submission. Nevertheless, in the event of any variance between the fees determined by Applicant and those determined by the PTO, please charge any such variance to the undersigned's Deposit Account No. 02-0375.

Respectfully submitted,

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Enclosure



はされていた。しかし従来のこの熱交換器のチューブ2は、第2図に示すように押し出しによりその内部に多数の複数の熱交換媒体通路を形成する構造を有していたので次のようを欠点を有していた。

- (1) チューブの内厚 $t_1$ 、 $t_2$ が製造上の問題であまり薄くできない(最小内厚0.8mm程度)。
- (2) チューブ内側の伝熱面積に限界がある。

④ チューブ内側を流れる熱交換媒体との熱伝達率を向上させるため、チューブ内側面の粗度をあらかじめ、突起をつけるといつた加工が全くできない。

このように押し出しにより製造したチューブを有する従来の熱交換器にかいては、チューブの熱伝達率を向上させるために取り得る手段が限定されるのでチューブの熱伝達率の向上、ひいては熱交換器全体としての熱交換性能の向上は期待できない。

本発明は、チューブの構造を改善することによって、その熱伝達率を増大させ、もつて熱交換器

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る。

第3図に示すように、厚さ0.5mm程度のアルミ板材をプレス加工して扁平チューブの半体7を作り、2枚の半体7を合せた間に、同じく厚さ0.15mm程度のアルミ板材を板状にプレス加工して形成した薄いインナーフィン8をサンドイッチ状にはさみ込んで第4図に示す状態とし、それらの各合せ目の側部9を第5図に示すように溶接10によって接合してチューブ2を製作する。インナーフィン8の両表面には、組立に先立つてインナーフィンエッジ低い融点を有するアルミろう材を嵌付しておく。次に第1図に示す従来の熱交換器と同様に、チューブ2は蛇行状に曲げ加工し、蛇行状のチューブの隣接空間に、第6図に示すように蛇行状に曲げ加工されかつ両表面にそれ自身より融点の低いろう材を嵌付されたフィン3を配置し、次いで加熱してチューブと一緒にろう付けする。この加熱の際、インナーフィン8の表面のろう材も溶けてチューブ内側と完全にろう付けされる。チューブの両端に第1図に示すようをヘッド

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の性能を向上させると共に軽量化を計ることを目的とする。

この目的を達成するため、本発明においては、複数で扁平なチューブの半体を形成し、2枚のチューブ半体の間に、板状に形成したインナーフィンをサンドイッチ状にはさみ込んで両半部を合わせ、各合せ目の側部を溶接により接合してチューブを製作した。チューブをこのように構成することによって次の効果が得られる。

- (1) 板材使用のため、押し出し材より薄い板材が使用でき、従つて第2図に示したチューブ内厚 $t_2$ を薄くできるので、軽量化がはかる。さらに板面の加工も自由であり、熱交換媒体側の熱伝達率向上のための加工ができる。
- (2) インナーフィンは非常に薄い板材が使用でき押し出し材に比べ内厚 $t_1$ は、きわめて薄くできる。さらに伝熱面積を大幅に増大できる。また上記凹凸フィン表面の加工で、熱交換媒体側の熱伝達率向上も可能である。

次に図面に示す本発明の実施例について説明す

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-4、5を従来のものと同様に設けて従来の熱交換器と同じ外観を有する熱交換器が作成される。なお本実施例にかいては、インナーフィン8及び外側のフィン3の両表面にろう材を嵌付したが、チューブ2の内表面及び外表面にろう材を嵌付し、加熱によりインナーフィン8及びフィン3をチューブ2の内表面及び外表面にそれぞれ同時にろう付するよりに構成してもよい。

チューブの各半体7をプレス加工する際、チューブ半体の内側表面は第3図に示すように滑らかな表面でもよいが、更に熱伝達率の向上が望ましい場合は、第7A、第7B図、第8図及び第9図に示すように、チューブ半体7の内表面7'に縦方向の凹凸11、交叉方向の凹凸12または横方向の凹凸13をつけて熱交換媒体との間の熱伝達率を向上する粗面に形成するとよい。この場合ろう材は粗面効果を減少させないようインナーフィン8の両表面に嵌付する。

またインナーフィン8についても、第10A、10B図に示すように表面8'に凹の穴14

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[The Translation of Reference to Figs. 7-9 of Ohara, Page 2, Column 6, Lines 9-18]

In case the press processing of each tube half object 7 of the tube is carried out, as shown in **Fig. 3**, the smooth surface is sufficient as the inner side surface of a tube half object 7. When the improvement of the rate of heat transfer to the further heat exchange medium is desirable, as shown in **Fig. 7A**, **Fig. 7B**, **Fig. 8**, and **Fig. 9**, it is good to make this inner surface 7' coarse by forming the unevenness 11 of the direction of length, the unevenness 12 of the intersection direction, or the unevenness 13 of a transverse direction in inner surface 7' of the tube half object 7. In this case, wax material is appended to both the surfaces of the inner fin 8, so that the effect by the rough surface may not be decreased.

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